NOTES:

HD 29866	The bright portions of $H\beta$ and $H\gamma$ are not clearly seen.
HD 33152	Remark in HD: "The line $H\beta$ is not seen as a dark line and is suspected to be bright. The other lines are hazy."
HD 33232	The lines $H\beta$, $H\gamma$ and $H\delta$ are very peculiar, consisting each of a strong, sharply bounded absorption line with the violet edge bright.
HD 45910	The hydrogen lines are of the P *Cygni* type.
HD 50138	The bright $H\beta$ line is double but unsymmetrical, the component to the red being much the stronger.
HD 55271	The brighter component of the wide double Burnham's G. C. 3887.

MILTON L. HUMASON.
PAUL W. MERRILL.

NOTE ON THE COMBINED EFFECT OF ELECTRIC AND MAGNETIC FIELDS ON THE HYDROGEN SPECTRUM.

The great majority of the lines in the spectra of sun-spots exhibit well-known characteristics of widening or of resolution into several polarized components, easily reproduced in the laboratory by the influence of a magnetic field. The peculiar behavior of certain lines, however, has led me to undertake two new series of experiments.

The first of these involves the use of a small electric furnace, mounted within the coils of a special magnet in such a way as to permit the Zeeman effect to be observed at any angle up to sixty degrees with the lines of force. Bright or reversed lines can be studied, the latter produced, as in King's recent investigations, by inserting a graphite plug in the resistance tube of the furnace. By this means it is hoped to repeat and extend to other elements the important observations by Zeeman on the peculiar inverse effect given by the sodium (D) lines.

The second series of experiments has been initiated for the primary purpose of determining whether an electric field, of sufficient intensity to be detected, exists in sun-spots. The hypothesis that the magnetic field is produced by an electric vortex suggests the presence of an electric field, but our attempts to discover it by searching for the stark effect have thus far given negative results. It struck me as barely possible that some of the peculiarities in the spot spectrum might be due to the combined effect of electric and magnetic fields on the lines in question. Even if this should not prove to be the case the experiment seemed worth trying, because of the physical interest of any new phenomena that might be detected in this way.

Preliminary attempts were made with a Weiss electromagnet, between the poles of which a hydrogen tube, of the form used by Lo Surdo and perfected by Anderson, was mounted with its axis at right angles to the lines of magnetic force. The intense magnetic field employed, however, drove the discharge against the sides of the tube, and obliterated the Crookes dark space before the cathode, in which the electric field exists. Pending an effort to overcome this difficulty by the use of a tube of special construction, advantage was taken of the recent completion of a large magnet designed by Anderson, which is especially adapted for the present experiment when conducted with the lines of electric force parallel to the lines of magnetic force.

This magnet, which will be more fully described by Dr. Anderson, consists of a large solenoid wound with bare copper tape cooled by a rapid flow of kerosene oil. With a current of 4000 amperes, given by our recently installed 500 kilowatt rotary transformer, it produces a uniform field of 32000 gauss within a tube 10 cm in diameter extending thru the solenoid. In the present case a current of 3000 amperes was used, giving a field of 24000 gauss.

The vacuum tube was supported within the solenoid, with its axis parallel to the lines of force. After being filled with dry hydrogen, it was pumped out until the dark space above the cathode was a few millimeters in length. A small right-angle prism, mounted close beside the vacuum tube, permitted an image of the dark space to be formed on the slit of the spectrograph. The observations were thus made normal to the lines of electric and magnetic force. The spectrograph employed is the one used by Anderson in his recent investigations of the spectrum of fine wires exploded by a condenser discharge. The Hβ line in the second order of the four-inch "Kenwood" grating was set at the center of the plate. A double-image prism, mounted before the slit, produced two images of the spectrum on the plate, one showing the components polarized parallel (p) the other those polarized at right angles (n) to the field.

When photographed without the magnetic field, the electrically resolved Hβ line shows with this dispersion two p components, widely separated at the surface of the cathode and tapering back to unite in a single line at the edge of the dark space, where the electric field disappears. There are also two n components, of similar form but less widely separated.

Under the combined influence of the electric and magnetic fields the appearance of the p components is apparently unchanged. Beyond the dark space the p component, subjected to the magnetic field alone, remains single, while in this region two parallel n components appear—the regular Zeeman effect for the Hβ line. Where they enter the dark space the two n components are weak and diffuse. From the present photographs it is impossible to say whether each of the n components is split into two parts by the electric field, but it is hoped that this may soon be settled with the aid of higher dispersion.

Some of the lines of the secondary hydrogen spectrum, when photographed in the electric field, disappear completely in the Crookes dark space, while others are but little reduced in intensity there. When photographed in the combined electric and magnetic fields, certain of the lines of the latter class seem to undergo a much greater reduction of intensity, tho the variations observed in different vacuum tubes are such as to require further confirmation of this result. As further investigations with higher dispersion are in progress, a detailed discussion of these changes will be postponed until better photographs become available.

Mr. Sinclair Smith, student assistant, has had an important part in this work, and deserves much credit for his preparation of the vacuum tubes and skillful manipulation. Dr. Anderson has given valuable advice on the design of the tubes and the arrangement of the apparatus.

GEORGE E. HALE.

SUMMARY OF MOUNT WILSON MAGNETIC OBSERVATIONS OF SUN-SPOTS FOR JANUARY AND FEBRUARY, 1921.

January and February showed no particular increase or decrease in spot activity. The average number of groups observed daily was 2.7 in January and 2.6 in February. Many of these groups were very small.

Records of activity in terrestrial magnetism on February 17th, 18th and 19th will be of special interest on account of the position and activity of No. 1811 on these dates.